THE MOVEMENTS OF CYCLONIC AREAS.[1]

THE Meteorological Council having undertaken a special discussion of the weather over the North Atlantic and adjacent continents for the thirteen months ending with August 1883, the period agreed upon for the international circumpolar observations, the preparation of the synoptic charts for the same area originally commenced by Captain Hoffmeyer, and since his death carried on conjointly by the Institute at Copenhagen and the Seewarte at Hamburg, was suspended for the time, and a new series was started from September 1, 1883. The charts are issued in quarterly volumes, and the "Vierteljahrs-Wetter-Rundschau" is a carefully-prepared summary of the principal meteorological features in each volume, to which is added a critical examination of the routes followed by sailing-ships from Europe to and from America, and to and from the equator, with tables showing the time occupied by each ship in sailing between certain latitudes and longitudes. Passage tables have always been a favourite study with mariners. Here there are hundreds of voyages tabulated in order of date, so that the sailing qualities of several ships are comparable from being under the same conditions of weather, and the value of the tables is therefore greatly enhanced.

The novel point in the work, however, is the introduction by Dr. Köppen of a new system of discussing the paths of storms. For some years past, meteorologists have been slowly coming round to the opinion that anticyclonic areas exercise a very important influence on the movements of cyclones; indeed, it may be safely asserted that the latter are almost entirely dependent upon the former for every stage of their progress. But although this is daily becoming more manifest, little has been done in the way of improving our mode of tracking cyclones. Ordinary track-charts represent the paths of storms during fixed periods of a calendar month, as if those of the early days were comparable with those of the end of the month—that the tracks, in fact, were regulated by time rather than by changing circumstances. A month's storm-tracks are so numerous, the direction of translation so varied, disturbances travelling in every conceivable direction—north, south, east, and west—and twisting round and round within a small radius, that to trace an individual disturbance is a work of no small difficulty. Even when the tangle is unravelled, there is nothing on the chart to show why one storm travels direct across the Atlantic to Europe in two or three days, another takes ten or eleven days, while others dart off through Davis Strait or by the east coast of Greenland to the Arctic regions; and the consequence is that we are left entirely to theorizing to explain the different movements, and theory has generally sought for the cause within the cyclones themselves. The more we examine synchronous weather-charts the more patent is it that cyclonic areas are strictly limited in their movements, both in rate and direction, by the surrounding conditions.

In NATURE, vol. xxxiii. p. 206, a diagram is given showing the track of a low-pressure system and its influencing anticyclone, the position of the lowest and of the highest barometer being indicated for each day. In the volume for 1880 of "Aus dem Archiv der Seewarte," the daily positions of the cyclonic centres for the first three months of 1878 are given, but the movement of maximum pressure is shown by a simple line without any indication of the position every twenty-four hours. Dr. Köppen has considerably improved on these plans. He has before him the daily charts for several weeks, and finds that for a number of consecutive days there is a general resemblance in the distribution of high and low pressure areas, the former almost stationary, the latter travelling along on the edges of the anticyclones. He selects the ruling type for the whole area of the charts, and then proceeds to represent the period of the type on one chart, the number of such periods in the twelve months ending with August 1884 being fifty-seven, ranging from three to eleven days each. The movements of the cyclones during the type are represented by lines joining the ascertained positions each day, and by a simple arrangement the lowest pressure and the force of the wind are represented daily. The anticyclones are treated differently, they are considered as practically stationary, and the isobar of 765 mm. (30·12 inches) being found on the charts every day, it has been adopted as the representative of the high-pressure systems. This isobar for the several days of the type produces a mean line which shows the average position of the anticyclone during the period. The maximum barometric values are shown near the centre, and also the direction in which the highest pressures moved, as in the volume already alluded to.

An examination of the results as shown by this method indicates that the question of storm tracking has been greatly simplified. Instead of twelve monthly charts full of tangled curves exhausting our patience to unravel them, we have about five for each month, the paths of disturbances during the prevalence of a type not varying greatly, and individual cases are followed without difficulty. The question of expense in lithographing the charts has apparently compelled Dr. Köppen to represent two, and even three, types on one chart, which tends to confusion; and if more of this kind of work is to be done, it will be well to strain a point to give each period by itself, so as not to perplex those who only occasionally deal with such charts. There are, however, several single periods to which a chart has been devoted, and a study of these only will suffice to convince us that an advance in the right direction has been made. Take the sixth and seventh charts representing the conditions between October 26 and November 1, and November 2 to 10, 1883, and the importance of the work is at once apparent. In the former the permanent anticyclone over the ocean is well south, while the European anticyclone covers all but the most northern parts of Scandinavia and Russia. The cyclones follow a well-marked path from America to Iceland and the White Sea. In the second case the Atlantic anticyclone is further north, and the European area has moved away to the eastward, and in keeping with these changes, the disturbances have also modified their directions. Speaking very generally, storm areas run parallel with the edge of the anticyclone. According to the position of the latter so do the cyclones advance, recede, or stand still. We see that land does not seem to offer any resistance to the advance of a storm area, the changes of direction in mid-ocean being quite as frequent as near the land. Tropical storms may either march due north, curve round by the American coast, or proceed to the western side of the Gulf of Mexico, and then cross the American continent to the Atlantic; but in each case we find the position of the anticyclone to govern the course followed. From a similar cause the rate of movement is also affected, varying quite as much on the level surface of the sea as in the midst of mountainous continents. In the chart for March 30 to April 11, 1884, the anticyclones over Europe, the Atlantic, Greenland, and America form a barrier allowing no means of escape for the disturbance which is seen to wind about from Davis Strait to the coast of Ireland and back again to the neighbourhood of its starting-point. The question of direction and rate, therefore, depends largely upon the position and stability of the anticyclones; and if we can in any way discover the resisting power of the latter we should no doubt greatly increase our ability to forecast changes. For the purposes of storm-warnings, it seems to be quite as necessary to know the conditions over Eastern as over Western

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[1] "Vierteljahrs-Wetter-Rundschau an der Hand der täglichen synoptischen Wetterkarten für den Nordatlantischen Ocean des Dänischen Meteorologischen Instituts und der Deutschen Seewarte." Parts 1 to 5, September 1883 to November 1884, with 41 Charts. (Berlin: Mittler und Sohn, 1887-38.)

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Europe, because it is on the existence or non-existence of anticyclonic areas over Russia that bad weather may either steer clear of our coasts, or pass clean over us and cause enormous damage to life and property.

Dr. Köppen's adaptation of composite portraiture for anticyclones will, when fully developed, doubtless lead to the discovery of principles which must be of considerable practical importance in our every-day life, and meteorologists should direct their attention to the discovery of some law which will indicate the approach of a change in the distribution of high barometer readings. At present we know absolutely nothing of what is taking place over the Atlantic out of sight of our own coasts, and the ordinary weather-charts cover such a small extent of North-Western Europe that they do not give us a fair idea of what the conditions are to the eastward. As the facts indicated become more fully known, we shall probably see an extension of the Weather Report area, and a corresponding improvement in forecasting.

The "Vierteljahrs-Wetter-Rundschau" appeared originally in various numbers of the *Annalen der Hydrographie und Maritimen Meteorologie*, the official publication of the Deutsche Seewarte, and are now reprinted in separate form.

NOTES.

THE members of the "Provisional Committee" appointed at the International Geological Congress in London, with reference to preparations for the next meeting of the Congress at Philadelphia, met at New Haven on Thursday, November 15. All were present except Dr. T. Sterry Hunt, who was confined to New York by illness. By vote, twenty-four members of the Permanent or Organizing Committee were appointed, as follows:—C. A. Ashburner, J. C. Branner, T. C. Chamberlin, G. H. Cook, J. D. Dana, W. M. Davis, C. E. Dutton, G. K. Gilbert, James Hall, A. Heilprin, C. H. Hitchcock, Joseph LeConte, Dr. J. Leidy, J. P. Lesley, O. C. Marsh, J. S. Newberry, J. W. Powell, J. R. Procter, N. S. Shaler, J. J. Stevenson, C. D. Walcott, R. P. Whitfield, H. S. Williams, Alexander Winchell. The Committee has power to add to its number. Dr. J. S. Newberry was appointed temporary Chairman. With this action, the duties of the Provisional Committee ended. The first meeting of the Permanent Committee will be held in Washington in the month of April. One of the publications presented to the recent session of the Congress in London was a voluminous Report on some important questions in American stratigraphical geology. We learn from an article in the December number of the *American Journal of Science*, by Prof. Dana, that, in his opinion, the views of the great majority of American geologists are not fairly represented in that Report. The Committee now appointed will certainly be regarded by geologists in Europe as a thoroughly representative one, which will, no doubt, take good care that the general body of geological opinion in the United States shall be adequately put before the world at the Philadelphia meeting.

ON Tuesday the completion of the ninth edition of the "Encyclopædia Britannica" was celebrated by a dinner given by Dr. W. Robertson Smith, the editor, in the hall of Christ's College, Cambridge. Upwards of a hundred contributors were present, and among them were many eminent men of science. Responding for "Science," Dr. Archibald Geikie said the old limits within which culture was confined had proved to be altogether too small for the progress of the present day. The soldiers of the republic of science had sometimes been accused of a strong desire to attack University culture and carry it by storm. For his part he wished that it might stand, but that no barrier should be interposed against the freest communion between the people inside and the newer and wider city around their borders.

AN Anthropological Congress is to be held at Vienna during August next.

AN important paper by Prof. Virchow, on "Land and People in Ancient and Modern Egypt," appears in the current number of the Transactions of the Berlin Gesellschaft für Erdkunde. It embodies some of the results of Prof. Virchow's ethnological researches during his recent visit to Egypt. It has hitherto been thought that the fellaheen of to-day are of exactly the same physical type as that of the most ancient known Egyptian population. Prof. Virchow, however, holds that the evidence afforded by the oldest sculpture, as well as by the skulls of the earliest period, tends to show that the primitive type in Egypt was brachycephalic, whereas the types which exist at the present time, and have existed for ages, are dolichocephalic and mesocephalic. Whether the change was produced by the influence of environment, or by the influx of new races, cannot, according to Prof. Virchow, be definitely determined by the evidence at present at our disposal; but, of the two views, the latter, he thinks, is the more probable.

THE inaugural lecture delivered before the University of Glasgow by Prof. Max Müller, as Lord Gifford's Lecturer in Natural Theology, has just been published by Messrs. Longmans, Green, and Co. In this lecture, Prof. Müller presents a most interesting account of the ideas which have regulated the work of his life. His conception of "the science of religion" will serve as the test, and, he hopes, the confirmation, of his theories relating to language, mythology, and thought.

THE New England Meteorological Society proposes to have a Loan Exhibition of Meteorological Apparatus, Photographs, &c., at the Institute of Technology, Boston, in connection with its fourteenth regular meeting in January 1889. The Society has issued a request for contributions.

THE Report of the Norwegian party of the International Polar Investigation contains the results of the observations which were made according to the programme decided upon at the Polar Conference at St. Petersburg, in August 1881. The observations were made at Bossekop in Alten, in lat. 69° 58′ N. and long. 23° 15′ E. of Greenwich. The first volume, issued in 1887, contains the astronomical and meteorological observations, and the second volume (Christiania, 1888) gives the results of the magnetic determinations and observations of auroræ. In the meteorological section, tables are given of the hourly readings of the temperature and humidity of the air, height of barometer, direction of winds and nature of clouds, extending from August 1882 to August 1883 inclusive, and concluding with monthly averages. In vol. ii. are given the records of the determinations of the magnetic declination and horizontal and vertical intensity. These were made fortnightly during the year, at intervals of five minutes during the day, so that the carefully-executed curves expressing the results of the observations are very detailed and convenient for comparison with the complete descriptions of auroral displays, the records of which are also contained in this volume. No doubt these results will be of great service in correlating auroræ with magnetic disturbances.

THE Royal Meteorological Society has published its "Meteorological Record" for the first quarter of this year, containing the monthly results of observations made at its stations, with remarks on the weather by Mr. W. Marriott. The Society commenced the organization of stations on a uniform plan in 1874, and these were supplemented by another class of stations, termed climatological, in 1880. Since 1881 the results have been published in a separate form under the above title. A map of the stations is issued annually, and shows that they are fairly well distributed, except in Wales. In addition to the monthly results, tables of daily rainfall are given for a number of stations, and of the

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